

An Analysis of Funding Liquidity Risk in the South African Banking System

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ABSTRACT

Key words: Funding liquidity risk, Asset-Liability mismatch, Deposit insurance.

Most emerging markets are faced with the predicament of a misalignment, or mismatch, of assets and liabilities in the banking sector where long-term assets are funded by short-term deposits. The South African (SA) banking sector also faces a challenge regarding the composition of the short-term deposits that fund these assets. The large and unstable wholesale funds dominate the funding side of local banks' balance sheets, particularly in the short-term bucket. The danger with wholesale funds arises when they are withdrawn unexpectedly, due to either perceived or realised risk. Due to their bulk, the wholesale funds have the potential to create a funding liquidity risk crisis in a bank. Most banks are unlikely to match these types of withdrawals, and will therefore have a forced asset fire sale to fund them. Retail funds do not face this danger, as it is highly unlikely, in normal market conditions, which many retail depositors would want to withdraw all their funds at the same time. Furthermore, retail funds are a cheaper source of funding compared to wholesale funds, thus making them a bank's preferred source of funding. In as much as they are a preferred source of funding, in the SA banking system retail deposits are very low compared to wholesale funding.

This research study explores the funding liquidity risk and the predicament that exists in the SA banking industry by highlighting its main sources, and providing recommendations on how it can be addressed. This is achieved by testing the relationship between the ratio of retail funding to total bank funding (ROBF) and five explanatory variables, namely: household saving rates; retail deposit rates; corporate saving rates; wholesale deposit rates; and the Johannesburg Stock Exchange (JSE) All Share Index, with the aid of the multiple regression analysis method. The regression analysis was performed on data collected between 2002 and 2011. The research established that household saving rates and retail deposit rates were predictors that were statistically significant in explaining the movement in the ratio of retail funding to total funding.

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GLOSSARY OF TERMS

ALM	Asset – Liability Management
ASISA	Association for Savings & Investment SA
BASA	Banking Association of South Africa
BCBS	Basel Committee on Banking Supervision
BG	Breusch-Godfrey
BP	Breusch-Pagan
BPG	Breusch-Pagan-Godfrey
DW	Durbin-Watson
FDIC	Federal Deposit Insurance Corporation
GDP	Gross Domestic Product
JB	Jarque-Bera
JSE	Johannesburg Stock Exchange
LCR	Liquidity Coverage Ratio
NCD	Negotiable Certificate Deposit
NSFR	Net Stable Funding Ratio
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least squares
PN	Promissory Note

ROBF	Ratio of retail funding to total bank funding
SA	South Africa
SARB	South African Reserve Bank
SASI	South African Savings Institute
UNDP	United Nations Development Programme
STeFI	Short-term Fixed Interest

1. INTRODUCTION

1.1 Research Area

Asset-liability matching is an inherent banking problem because banks fund their assets with demand deposits (Goldstein & Pauzner, 2005:1293), (Song & Thakor, 2007:2130), and (Haim, 2008:63). Banks' assets are generally illiquid in nature compared to the demand deposits that fund them, and this liquidity mismatch creates a risk for banks when large and unforeseen withdrawals take place. As banks do not usually have to hold too much cash, these withdrawals are therefore funded by redeeming banks' assets in a fire sale type situation (Bank of England, 2000:93), (Toby, 2006: 57), and (Song & Thakor, 2007:21-30). Owing to factors such as the poor history of domestic household savings, SA banks depend largely on wholesale funding, which is more expensive than retail funding (KPMG, 1998:43). In order to assess how rates offered to these depositors affected levels of domestic retail funding, this research paper will compare the rates of interest offered to depository funding or retail markets to the rates of interest offered to institutional and wholesale funding. Furthermore, this research studies trends of saving rates in SA household and corporate sectors. The returns of the equity market are also considered in an attempt to shed some light on how these factors affect depository funding levels, which is key to managing funding liquidity risk in banking.

Funding liquidity risk is a trade-off between cash inflows and outflows, and more importantly, the term structure of maturing liabilities and maturing assets. Therefore, a bank requires predictable behaviour of its funding sources regarding cash flows so that it can effectively manage its funding liquidity risk. Wholesale funding constitutes a large portion of deposit funds in the SA banking sector. Due to wholesale funding's short-term nature it poses a greater risk in the industry (see Figure 1.1 & 1.2), as it comprises bulk funds from a few institutions that are placed on short-term buckets, and have highly unpredictable cash flow characteristics. These funds are normally rolled over at maturity, that is, overnight funds are rolled over for the following day, or short-term deposits, such as those deposits maturing in

five days, are placed for another five days with the bank upon maturity. The problem arises when these funds are not rolled-over, but are withdrawn instead. Banks normally assume these deposits will be rolled-over as a matter of business-as-usual, and thus they do not hold cash in case of non-roll-overs, resulting in a liquidity squeeze due to the size of these deposits. Money market instruments are a recent feature in the SA banking sector and they have experienced a phenomenal growth (see Fig 1.3). They provide much needed funding to banks, however too much reliance on these funds exacerbates the sector liquidity situation, as they are another form of wholesale funding.

1.2 Problem statement

This research will examine five factors that are perceived to influence the level of retail funding in the SA banking sector. These factors are: retail deposit interest rates; wholesale interest rates; household saving rates; corporate saving rates; and stock market returns. The first question the research attempts to answer is to establish if the emergence of money market funds in the SA market, which earn a higher rate of interest than retail demand deposits, contributed to low levels of depository funding in the SA banking sector (see Figure 1.2). Secondly, the research estimates to what extent the retail deposits funding to total bank funding ratio of banks can be attributed to trends in the household saving rate.

South Africa's saving rates measured by gross savings as a percentage of gross disposable income, declined steadily for most part of the last decade before improving slightly in 2008 and 2009 (United Nations Development Programme, 2011:12). A closer look at this trend reveals that it is only the corporate sector that contributed to this slight improvement, both government and the household sector were dissavers over this period. Corporate savings increase bank deposits, and this research will estimate the impact of the corporate sector savings trend on the ROBF in the SA banks' balance sheet. Juster *et al.* (2004:11) measured the impact of capital gains received by households during the stock market boom of the 1990s against the decline in the personal savings rate in the United States (USA); they established that most of the decline in the personal savings rate in the USA during the 1990s can be explained by the extraordinary growth in the value of corporate equities. Another

question the research attempts to answer is whether or not the unprecedented rise in the SA stock market in recent years has affected the retail funding of banks.

1.3 Purpose and Significance of the Research

1.3.1 Purpose and research objectives

The main aim of this research is to analyse the causes of low depository funding in the SA banking sector. In pursuit of this aim the following objectives are considered:

1. To estimate the effect of offering competitive interest rates to institutional and wholesale funds in comparison to the low interest rates offered to retail depositors by banks, on the levels of retail deposits in the SA banks' balance sheets.
2. To measure the impact of household and corporate saving rates on the retail deposit ratio to total liabilities of SA banks.
3. To determine the extent to which the phenomenal equity returns of the recent years have contributed to low level of depository funds.
4. To provide recommendations on how to deal with the funding liquidity predicament in the SA banking system, and highlight the policy implications of the findings for policymakers and the banking industry.

1.3.2 Significance of the research

This study is important in the banking and finance sectors, specifically to the area of assets and liabilities in banking. Ratnovski and Huan (2009:10) found that much of the Canadian banks' resilience during the recent financial crisis was explained by the banks' funding structures. Canadian banks relied more on depository funding, much of which came from retail sources such as household, and less on wholesale funding. SA banks are in the process

of implementing Basel III, a regulatory framework imposed by the Basel Committee on banking supervision, of which South Africa is a member. Basel III proposes two liquidity requirements, namely, Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR), the latter of which is intended to promote resilience of banks by creating incentives for a bank to fund its activities with more stable sources of funding, to provide a sustainable maturity structure of assets and liabilities (Basel Committee on Banking Supervision, 2011: 9). SA banks are heavily reliant on wholesale funding (see figure 1.1), which is considered to be more volatile than more stable retail funding; this reliance poses a challenge in meeting the NSFR requirement. The research provides significant information of the causes of low levels of retail/depository funding in the SA banking system. The study provides insight to practitioners and academics into the funding liquidity dilemma. It also provides practical methods for policy makers and practitioners alike to deal with this issue.

1.4 Research Questions and Scope

Research question 1:

Is the low rate of interest offered to retail funds, compared to interest rates offered to wholesale/institutional funding, a reason for the declining core deposits in the SA banking sector?

Research question 2:

In the SA banking sector, to what degree, if any, do household and corporate saving rates affect the level of core deposits of the banks' liabilities?

Research question 3:

What impact does the domestic stock market performance have on core deposits in SA banks' balance sheets?

1.5 Research Assumptions

There was no distinction made between the funding liquidity position of small and large banks as the study was conducted at industry/sector level. The following assumptions were thus applied:

Assumption 1: SA banks have similar funding liquidity positions.

Assumption 2: Banks call deposit rate differences are negligible due to competitiveness in the industry.

Assumption 3: Call deposit rates of banks are not an indication of the banks' funding liquidity risk positions or perceptions.

1.6 Structure of the study

There are six sections in this study and the remainder of the research paper is structured as follows. Chapter 2 provides theoretical and empirical literature on banking asset and liability management, funding liquidity risk, and advantages and shortcomings of deposit insurance. Chapter 3 highlights an overview of the SA banking sector. Chapter 4 comprises the research methodology. Chapter 5 discusses the interpretation of the results. Chapter 6 contains conclusions. Policy recommendations and recommendations for future research are discussed in Chapter 7.

2. LITERATURE REVIEW

2.1 Introduction

This dissertation is related to other literature in banking funding liquidity risk. It differs from other quantitative studies in measuring funding liquidity risk in one aspect. It is an ex-post analysis of factors that contribute to the build-up of deposit funding in banks. In other words the study does not only look at the current composition of the liability side (deposit funds) of a bank's balance sheet and assess funding liquidity risk but looks at factors that shaped that composition.

The core business of banks and their role in the economy is that of maturity transformation, and this is achieved by issuing short-term liabilities such as money market instruments, fixed deposits, and other banking products to fund long-term assets such as vehicles, property, and other assets (Sawada, 2008:2). The maturity transformation function of banks has a potential to give rise to risks that can render these institutions unviable as (McCoy, 2007:4) argues that banks are inherently fragile, owing to the structure of their balance sheets where a significant portion of liabilities are short-term, assets are long term. Thus, unanticipated withdrawals, owing to the viability of banks due to macroeconomic shocks such as the 2008/9 financial crisis, create risk for banks (Song & Thakor, 2007:2130). This risk is called funding liquidity risk and Diamond & Rajan (2001:287) defined this risk as unanticipated demand by depositors who may arrive at the bank at an inconvenient time and force a bank to sell its illiquid assets abruptly. The fire sale of these illiquid assets can give rise to massive losses as most of these assets will be sold at discount and thus a possibility of insolvency, a situation where liabilities exceed assets remains high. Drehmann & Nikolau (2009:1024) in a similar manner defined funding liquidity risk as the possibility that a bank will become unable to settle its obligations with immediacy over a specific time horizon.

This section contains a literature review of key themes relevant to the study. The chapter is divided into four sections. The first part provides a review of empirical literature on funding liquidity indicators, funding liquidity risk and quantitative methods employed by different authors to measure the latter. The second area is the importance of retail deposits as a funding source to banks in comparison to wholesale and institutional funding. Thirdly, is

how domestic household and corporate saving rates affect banks' retail funding, in particular core deposits ratio to total funding of banks. Lastly, the literature review will discuss relevant studies relating to equity markets growth impact thereof on levels of depository funding in banks.

2.2Funding liquidity indicators and funding liquidity risk

2.2.1 Funding liquidity indicators

In its Basel III accord, Basel Committee on Banking Supervision (BCBS) developed two liquidity ratios (LCR and NSFR) that are aimed at promoting short term and long term resilience of liquidity risk in banks. LCR seeks to ensure that banks keep sufficient level of high quality liquid assets that can be easily converted to cash to enable the bank to survive a liquidity stress scenario for at least one month (Basel Committee on Banking Supervision, 2011: 3). LCR specifies that banks should keep a buffer of high quality assets to cover cash outflows over the next 30 calendar days. This ratio is thus more concerned with the short term survival of a bank as it does not include any period over 30 days. NSFR however addresses the long term viability of a banking institution as it looks beyond the first 30 days of a liquidity stress scenario. NSFR seeks to achieve asset liability matching by encouraging banks to fund their long term assets with long term liabilities, thus limiting over reliance on short-term wholesale funding (Basel Committee on Banking Supervision, 2011:25). NSFR is more relevant to the South African banking sector as it is characterised by heavy reliance on wholesale short-term deposits to fund its long term assets (Bank Supervision, 2011:66). These two ratios are minimum regulatory guidelines and banks do have their own internal liquidity ratios that are used as a guide to assess the liquidity position of the institution.

Acharya, Shin & Yorulmazer (2010:2169) showed that cash:asset ratio was an important factor for banks leading up to the 2007-2009 financial crisis where they found that US banks cash to asset ratio had declined from 10 per cent in the 1980's to just under 3 per cent before the crisis. Their results showed that there were instances where high cash holdings were not only used to shield the bank from liquidity crisis but was also used as a strategic tool to acquire other banks in the aftermath of anticipated bank crises (Acharya, Shin & Yorilmazer, 2010:2186). Cash unlike other assets does not require haircuts in a fire sale situation and

thus, having a cash buffer in a liquidity crisis scenario can lessen the impact of large withdrawals that ordinarily would have devastating impact if cash holdings were low. Indeed, cash is the most liquid form of bank assets and it can therefore be used to settle unanticipated bank obligations such as wholesale deposit withdrawals at the back of a systematic stress situation and thus averting insolvency of a banking institution. However, a bank needs to strike a balance between holding too much cash as this can affect the profitability of the bank by not lending in profitable transactions and holding optimum balance that will shield it from a run on the bank.

2.2.2 Funding liquidity risk

Funding liquidity risk has been discussed widely and a number of studies have attempted to measure it, using different techniques (Bruna, 2010, Eisenschmidt & Tapkin, 2009, Gatev *et al*, 2007, and Diamond & Rajan, 2001). Drehmann & Nikolaou (2009: 1024) define funding liquidity as the ability of a bank to settle obligations immediately when they become due. As such, they defined funding liquidity risk as the possibility that the bank will become unable to settle obligations with immediacy over a specific time horizon (Drehmann & Nikolaou, 2009:1024). Funding liquidity risk is thus a balancing between cash inflows and outflows, and more importantly, the term structure of maturing liabilities and maturing assets. Their assessment is banks would be able to model funding liquidity better if the timing of all the cash flows was certain but this is not always the case as the timing of cash flows for significant portion of bank assets and liabilities are uncertain. The business usual assumption of banks do not hold at all times, indeed there are instances where notice deposits are withdrawn before maturity and times where loans such as mortgage loans are settled before they mature.

Ratnovski & Huang (2009: 10) found that the funding structure of banks, which was a proxy to rollover risk, as measured by the ratio of depository or retail funding, was a significant predictor of bank resilience during the 2008 financial crisis. They further found that low wholesale funding in Canadian banks in comparison to other OECD banks, was one of the main reasons that Canadian banks escaped unscathed from the 2008 financial crisis. This

shows the importance of a bank's reliability to a particular funding source as most banks that failed during the recent financial crisis had funding liquidity squeeze which was preceded by too much reliance on wholesale funding. Their study shows the major contributing factor to the strength of the Canadian banking system but it falls short in analysing the reasons behind the make-up of the balance sheet structure of these banks and other locations (countries) included in the study. For instance, dependency on a type of funding source might be structural and thus making banks to be subject to a phenomenon they cannot control. This can include factors such as low personal saving rates, superiority and wide range retail investment product compared to bank deposits and the like in their location to which Canadian banks might not be exposed.

Drehmann & Nikolaou (2009:13) measured liquidity risk by observing banks' bids over time during open market operations (OMO) of the Central Bank in the European market. They observed that banks with higher funding liquidity risk are inclined to bid more aggressively as they are willing to pay a higher price to obtain funds from the Central Bank. In this way, they measured the net volumes of Central Bank money needed by a bank to avoid illiquidity and showed that higher bid reveals higher funding liquidity risk. Therefore they measured funding liquidity risk by the spread between the submitted bid by a bank and the minimum bid rate. This approach cannot be applied in locations where not all banks have access whether voluntarily or by design to the Central Bank funding as is the case in South Africa.

Ratnovski & Huang (2009:8-9) measured liquidity in a bank's balance sheet as ratio of liquid assets, which include, cash, government bonds, short-term claims on other banks, to total liabilities. A higher ratio indicated a strong balance sheet liquidity position which provided a temporary relief from funding pressures during the recent financial turmoil. This approach is more practical and easy to implement but it however does not consider haircuts to other assets such as short-term claims on other banks in the ratio which might not be available during a systematic stress situation as other banks might be having a liquidity squeeze at the same time. In a similar fashion Aikman *et al.* (2009: 14) used the "full danger zone" framework to estimate funding liquidity risk in a bank, and it only covers unsecured funding markets. They used a scale of 0 - 100, measuring banks on a number of variables in which a bank scores between that range, depending on how it is assessed on a particular variable. For

instance, the higher a bank's short-term wholesale mismatch (liquidity) and market funds reliance, the higher its score. They defined banks that scored less than five points as safe, and would receive funds withdrawn from troubled banks during a stress period, thus capturing flight to quality effects. Similarly, banks with scores of twenty-five or higher, trigger the closure of long-term unsecured funding markets to those banks, thus resulting in a funding liquidity squeeze. This approach also highlights the vulnerability of banks with heavy reliance on wholesale markets as indicated by their short-term wholesale mismatch.

Wetmore (2004:100) used a multiple regression analysis to assess the relationship between the growth of loans to core deposits ratio, and commercial bank stock return in the US market between years 1992 to 2000. As core deposits are perceived to be a stable part of a bank's liabilities, deterioration in this ratio should be reflected in the bank stock prices if investors considered it to be risky. The regression results showed that the level of loans-to-core-deposits was negatively and significantly related to the measure of market risk of the bank (Wetmore, 2004:103). These results indicated that low levels of core deposits which are a proxy for funding liquidity risk in this context explained the level of vulnerability as shown by the decline in the bank stock prices during that period.

Brunnermeier *et al.* (2012) took a different approach by measuring liquidity mismatch among assets and liabilities and thus not looking at one side of the balance sheet which most authors have but analysing both assets and liabilities. Here, cash equivalent weights are assigned to each asset and liability to assess how much the maximum amount of cash that can be raised for a given asset to match a liability of the same duration a systematic crisis. It not clear how these weights are determined and importantly these weights are not backed by empirical evidence such as haircuts that should be applied to illiquid assets as experienced during the recent financial crisis. Adrievskaya (2012) offers a simple approach utilising Brunnermeier *et al.* (2012) methodology but only applying to the short-term bucket of the bank balance sheet and without the weights assigned to assets and liabilities. This approach assess an individual's bank funding liquidity risk based on a surplus of liquid assets in the short-term bucket of the balance sheet and aggregate the results using Independent Component Analysis (ICA) for the sector analysis. This approach is an improvement of the Brunnermeier *et al.* (2012) method but it also falls short in addressing funding liquidity risk beyond the short-

term bucket of the balance sheet. The recent financial crisis showed that investors are willing to take haircuts to unwind long term positions during a period of stress, thus affecting balance sheet items beyond the first 30 days.

There is no single uniform measurement of funding liquidity risk as shown above, but a banks' balance sheet structure seems to feature more in the different measurement methods. Also, reliance on either wholesale market funds or core deposits/retail funds appears to be a common feature in proxies for measuring funding liquidity risk. This research uses the ratio of retail funding to total bank funding as a proxy to the measure funding liquidity risk. The following section discusses features of wholesale funding and retail funding relevant to funding liquidity risk.

2.3 Retail and wholesale funding

Banks borrow wholesale funds through wholesale money markets; these funds are usually raised on a short-term rollover basis with instruments of large denominations to supplement retail deposits (Huang & Ratnovski, 2010:3). Huang & Ratnovski (2010:7) further argue that retail deposits provide a more stable source of long-term funding to a bank than volatile wholesale funds. This is due to the fact that retail deposits sluggish and insensitive to risk, whereas the wholesale funds are supplied on a rollover basis and could be withdrawn before they mature, thus forcing a bank into liquidation. Empirical studies focusing on the liability side of the balance sheet of banks have similar findings, in that heavy reliance on wholesale funds can put the viability of a bank at risk during crisis times.

In their earlier study on large commercial banks in the Organisation for Economic Co-operation Development (OECD) countries Huang & Ratnovski's (2009:3) demonstrated that funding structure was the strongest predictor of bank performance during the 2008/9 financial crisis. Canadian banks were evident to this as their equity prices did not decline significantly during that period as their banks had more retail deposit funding ratio on the funding side (Huang & Ratnovski, 2009:3). Furthermore, banks depending heavily on wholesale funding are positioned for the risk of serious liquidity shock (Wetmore, 2004:100).

Banks experience this liquidity shock due to drying up of wholesale funding, owing to tendency of this funding type to be nervous money, particularly if the bank's soundness is in question. This phenomenon was evident during the demise of Northern Rock (Shin, 2009:103), the fifth largest mortgage lender in the UK in 2007. Northern Rock's business model made it susceptible to adverse developments in wholesale markets as it relied heavily on securitisation and funding from wholesale markets, rather than retail deposits (Yorulmazer, 2009:2-4).

Toby's (2006:58) analysis of causes of liquidity in crisis in the Nigerian banking system found that many bankers in the country agreed that heavy reliance of purchased liquidity from sources such as the interbank money market were among the major concerns. Aikman et al. (2005:19) used a 'danger zone' frame work to analyse funding liquidity risk in the UK banking sector. They found that banks with a heavy reliance on money market funds and short-term funding experienced more liquidity pressure during times of crisis than banks with more reliance on retail funding sources.

Lambrechts (1995) depicts money market funds as an investment vehicle that pools small depositors' money and gets larger competitive rates for it, and thus should, in a normal environment, dominate demand deposits in banks. The marketing and the superiority of these types of funds in both return and flexibility point of view has a potential to attract vast amount of funds that ordinarily would be deposited in banks. They offer competitive rate of return and are flexible in that an investor can give a one day notice to withdraw funds whereas they might have to give a one month for a bank deposit and these funds fee structure is more transparent. In its report on bank margins and profitability in SA KPMG (1998) found that vast amount of retail funds that could have been invested or deposited with banks was channelled to money market unit trust funds, as it was viewed as an attractive alternative investment option.

In conclusion, banks with too much reliance on wholesale funding are shown to be more susceptible to funding liquidity risk than banks with more dependence on retail markets. As its name suggests, funding liquidity risk has more to do with funding of the bank's assets or the composition of its liabilities. Therefore the choice to use ROBF to measure funding liquidity risk in this research is motivated by the fact that retail deposits are considered to be

safest form of bank funding as compared to other funding sources as such its portion of total sources of funds is a good indication of funding liquidity risk position. Significant portion of deposits in South African banks are derived from the corporate and household sectors as depicted by figure 3.3. Therefore, household and corporate saving rates are crucial in discussing funding liquidity risk as they shape banks' balance sheet structure over time and these concepts are discussed in the next section.

2.4 Household and corporate saving rates

2.4.1 Household savings

According to Browning & Lusardi's (1996:1797), a simple definition of household saving is that it is the residual between income and current expenditure. Prinsloo (2000:3) however, categorises household savings as follows: firstly, as contractual savings that are in the form of a series of payments such as retirement annuities, pension fund contributions, and insurance policies; and secondly, as discretionary savings which involve savings where households are not bound by any fixed commitments. These two definitions differ; the first definition does not distinguish between contractual savings and current expenses as they form part of current expenditure for salaried employees in many instances. Household saving rates used in this research is the ratio of saving by households to disposable income of household savings by household includes both contractual and discretionary savings.

Aron & Muellbauer (2000), Kotze & Smith (2008) and Cronje & Roux (2010) suggests that financial liberalisation and subsequent deregulation of the financial markets in South Africa in the 1980's led to significant increase in levels of debt and subsequent decline in personal savings as banks had more cash available for lending. Cronje & Roux (2010) went further in their analysis and included other factors which they argue contributed to low saving rates in South Africa. These factors included South Africa's high income inequality which resulted in the majority of the population having little or no income. Aron & Muellbauer (2000) argues however, although the bulk of savings will come from most privileged households in South Africa that by itself should not have an influence on aggregate saving behaviour in the

country. They conclude that a significant contributor to the rise of consumption-to-income ratio among South Africans which has a direct consequence to household saving rates is due to financial liberalisation and income expectations. Lusardi's (2008) paper on household saving behaviour in the US found that low literacy levels, ignorance and lack of information contributed to low saving rates among different demographic groups.

2.4.2 Corporate savings

There are numerous studies on corporate savings such as Aron & Muellbauer (2000), Prinsloo (2000), and Gale & Sabelhaus (1999), and they all define corporate savings similarly as net corporate income less tax and net interest paid and less dividends after adjusting for depreciation and inventory valuation. Prinsloo (200:14) argues that corporate savings could be viewed as an extension of household savings in that, corporate sector saves on behalf of its shareholders who are the very same households. In as much as corporate savings are an extension of household savings through share ownership by individuals; Aron & Muellbauer (2000) found no evidence in support of corporate saving behaviour to have been informed by changes in personal tax rate on dividends. Company earnings are driven by economic activity and thus earnings growth is linked to Gross Domestic Product (GDP) growth (Cornell, 2010:54). Thus, corporate profits from which corporate savings are derived have a positive relationship with the GDP. For the purpose of this research, savings deposits of the domestic private sector as a ratio of the Gross Domestic Product (GDP) is used to proxy corporate saving rates.

As mentioned in section 2.2 above, main funding sources for banks is wholesale deposits and retail funds which in the main come from private companies and household surpluses. Therefore the rate at which both these sources save should have an impact on the liability structure of South African banks, although at the same time not discounting other investment vehicles outside of the banking sector assets. Company shares which are listed in the stock market are another asset class in which both private companies and individuals can invest surplus funds and it is a discussion for the next section.

2.5 Equity market returns

Wetmore's (2004:99) analysis of the loan to core deposit ratio in USA banks found that the ratio was increasing, owing to core deposits that were growing at a rate below the loans' growth rate and there are a variety of reasons for this occurrence. The author found, amongst other things, that a decline in interest rates and an increase in the stock prices encouraged individuals to move funds from savings accounts to other investments; this study was done over a period of nine years covering year 1992 to 2000. Similarly, Juster *et al.* (2004:11) and Poterba (2000:100) concluded that the decline in the personal savings rate, in the form of traditional interest bearing deposits in the USA since 1980s, could be explained by unprecedented capital gains in corporate equities experienced over this period. In line with these findings, Hufner & Koske (2010:19) found that the volatility of the household saving ratio in Germany was attributable to stock market fluctuations in the late 1990s and 2000s. Furthermore, Garner (2006:10) states that "recent sharp increases in stock market values and home equity may have raised consumption relative to current disposable income, lowering the measured saving rates". By contrast, Gardner (2006:11) found that, owing to stock market volatility, recent gains in the stock market in the USA are unlikely to alter household savings behaviour, as they are aware that stock market gains cannot persist over a long term.

The equities/stock market is relevant to the discussion of funding liquidity risk, particularly on how it affects private individual's surplus savings behaviour as argued above. The recent phenomenal stock market returns in South Africa might have altered investment behaviour of certain individuals as they expected the good run to continue. This could have resulted in swaying of funds that ordinarily would have gone to bank saving deposits, thus contributing to retail deposits to the equities market thereby reducing ROBF.

2.6 Conclusion of literature review

This chapter has presented a review of relevant literature on the definition and measurement of funding liquidity risk. This analysis will be critical in understanding the remainder of this research. The literature has shown that despite the fact that funding liquidity risk is inherent in banks, owing to the structure of their balance sheets and heavy reliance of wholesale funding further exacerbates the problem. With regard to measurement of funding liquidity

risk, this chapter has shown that although there is no universal measurement, one common factor is the importance of core deposits in a bank's balance sheet. Furthermore, it has also been established that wholesale deposits are a volatile funding source for banks, and the 2008/9 financial crisis exposed this notion where jurisdictions whose banks had high wholesale deposits relative to retail funding required bail outs.

Understanding the behaviour of bank liabilities, specifically the fact that wholesale deposits are much more volatile than retail deposits is important in diagnosing the funding liquidity risk problem. In addition, the desired liability profile of a bank is to have a large concentration of liabilities in stable core/retail deposits and thus understanding factors contributing to this desired position are vital. The next chapter provides an overview of the South African banking sector and performance of selected economic indicators.

3. AN OVERVIEW OF THE SOUTH AFRICAN BANKING SECTOR AND SELECTED ECONOMIC INDICATORS

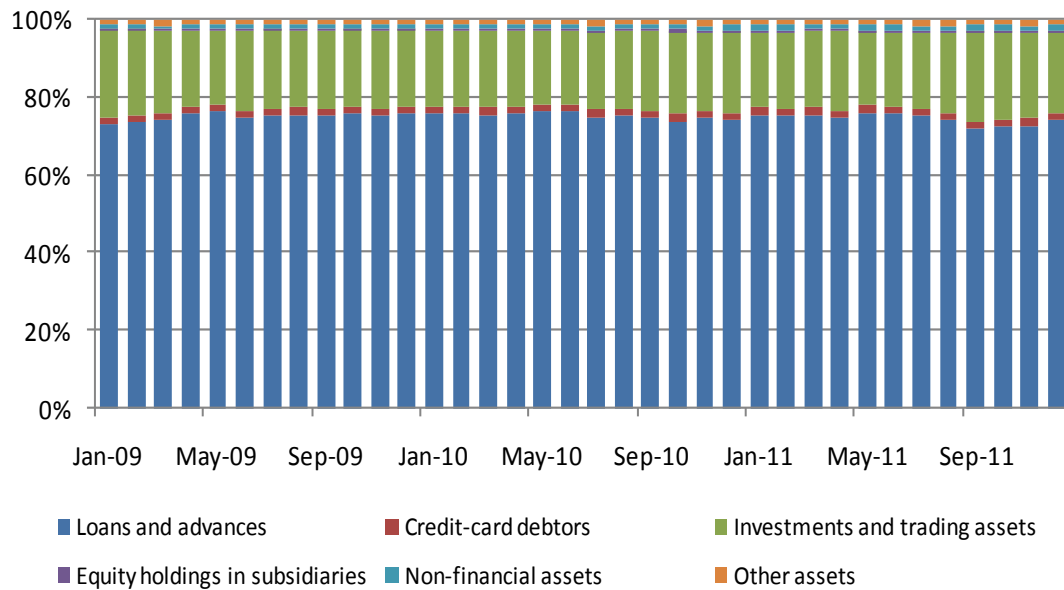
3.1 Introduction

This chapter provides an overview of the structural features of the South African banking sector and performance of selected economic indicators, and is divided into five sections. Section 3.2 provides information on the structure of the SA domestic banking sector, and section 3.2 shows the trend of the SA household saving rates. In section 3.3, corporate saving rates trend is discussed, JSE All Share Index returns over the past decade are discussed in section 3.4 and the chapter concludes in section 3.5.

3.2 The structure of the South African banking sector

South Africa has an established and well-regulated banking sector, regulated by the Bank Supervision Department, a unit of SARB which is a member of the Basel Committee on banking supervision. The SA banking sector is highly concentrated among the four largest banks that accounted for 84.1 per cent of the total banking-sector assets as at the end of December 2011 (Bank Supervision Department Annual report, 2011:55). Using the Herfindahl-Hirschman Index, a widely respected barometer for measuring market concentration, the SA banking sector concentration measured 0.187; this indicates a high level of concentration at the end of December 2011. SA banks provide a range of services in the following markets: retail banking; home loans; vehicle and asset finance; corporate banking; investment banking; and trading. The traditional banking intermediation of channelling surplus savings to deficit borrowers still constitutes a significant portion of banking activities, as depicted in figure 3.1 below. Traditional banking activities represented by loans and advances constituted around seventy four per cent of total banking sector assets as at the end of December 2011.

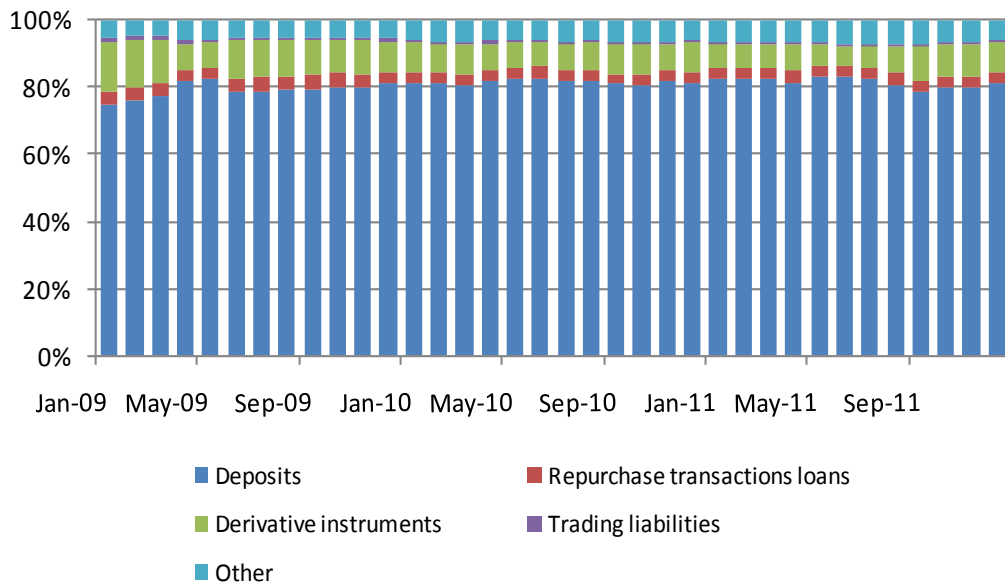
Figure 3.1: Composition of total banking sector assets



Source: SARB, 2012

The liability side of the banking sector is also largely dominated by traditional activities as depicted in figure 3.2, where deposits constituted about 82 per cent of total bank liabilities as at the end of December 2011. Sources of SA bank deposits – the liability side of the balance sheet that is the main focus of this research.

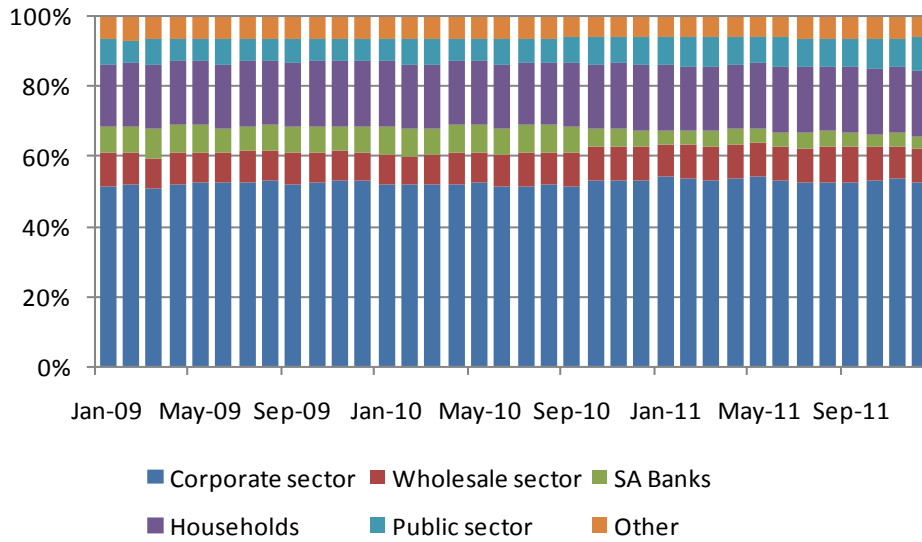
Figure 3.2: Composition of liabilities



Source: SARB, 2012

Deposits from retail customers, that provide a stable and cheap source of funding for the banking sector, only constituted around 18 per cent of total deposits as at the end of December 2011 (see figure 3.3), and the remainder emanated from other sources which are volatile for funding liquidity purposes. These sources can pose a serious risk to the viability of a bank during a period of stress due to their size and dissemination of information. The recent financial crisis revealed how quickly organised bank funders such as wholesale markets through money markets and corporate funds can bring down a bank in a matter of days as was the case with Northern Rock in the UK. Wholesale and corporate bank funders which are active in the financial markets are the first to receive bad information about financial health of a bank and act on that information by withdrawing funds from the affected bank. This will cause a bank failure if they withdraw their funds at the same time, which is a likely scenario as they have the same information normally have large sums of money than other bank depositors. Retail customers on the other hand do not get this information at the same time and therefore when bad information about their bank hit the news, the bank is likely to have enough time to activate funding liquidity contingency plans. Therefore having large portion of deposits concentrated in wholesale and corporate sector can have devastating impact in a bank's viability during a period of stress and this funding liquidity risk is likely to be a catalyst.

Figure 3.3: Sources of total deposits



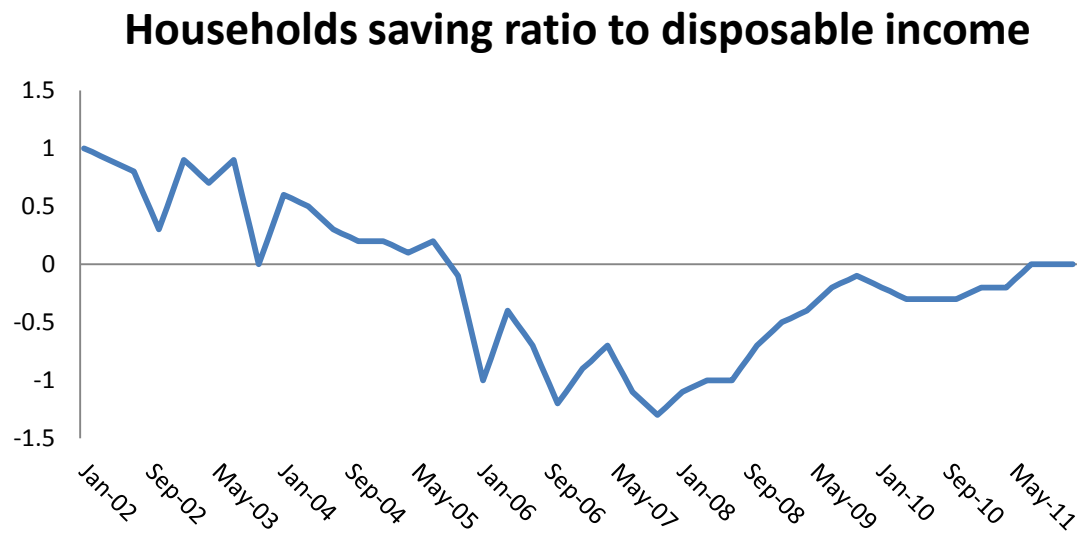
Source: SARB, 2012

3.3 Trends of household savings rate in South Africa

Household savings rate have been poor over the recent times, in fact it declined over the past decade, but steadily increased towards the latter part of the decade (see figure 2.2 below). Cronje & Roux (2010:22) suggest that the decline in SA household saving rates is due to four factors:

1. Demographic trends are not supportive of high household saving rates as the country has high dependency ratios, either young or old;
2. The persistent income equality, in which the majority of the population is in survival mode as a result of very low incomes, reduces the propensity to save.
3. A lack of savings options and facilities contributes to this low rate; and
4. Financial liberalisation, characterised by easy access to credit, resulted in households maintaining high levels of consumption.

Figure 3.4: Graph showing South African household saving rates.



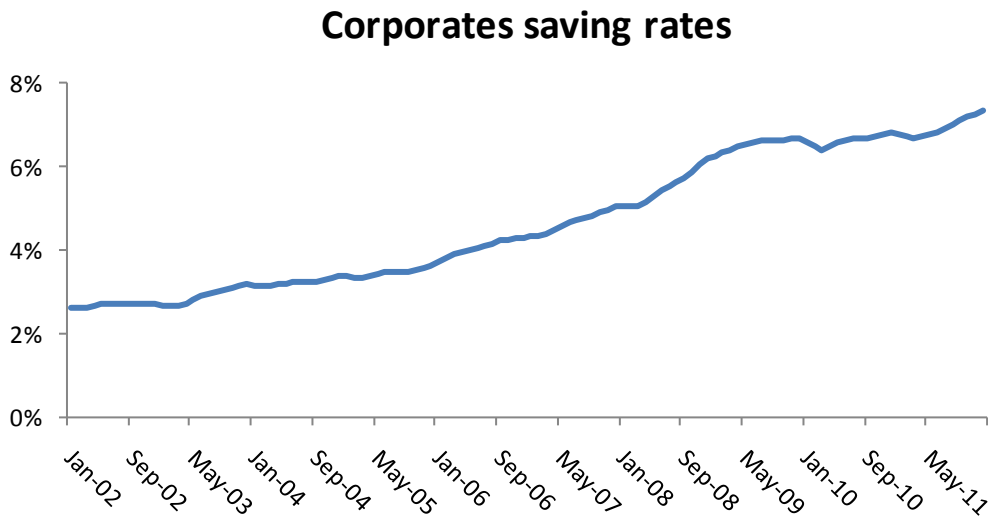
Source: SARB, 2012

Figure 3.4 above shows the household saving rates over time, from January 2002 to December 2011. It can be seen from the graph that household savings declined from positive levels to negative levels between 2002 and 2008 and steadily improved to 2011 although did not break through the zero mark. The South African National Treasury attributes this poor saving rates to three factors; Firstly, it relates to high unemployment levels the country experienced during that period; secondly, relatively low household income levels as compared to other emerging economies and thirdly, a bias towards present consumption which is accompanied by a corresponding increase in the indebtedness of household (National Treasury,2012:6-7). Household savings are an important component of the level of retail funds placed with banks but it is only discretionary savings that contribute to depository funding as contractual savings such as pension funds by pass the banking system to pension funds and other life products.

3.4 Trends of corporate savings rate in South Africa

Corporate savings are correlated to economic activity, as they are a function of retained income of companies after they have paid dividends, interest, rent and royalties to shareholders and other interested parties (Prinsloo, 2000:4). These savings found their way to balance sheets of commercial banks and they add to wholesale funds which exacerbate funding liquidity risk.

Figure 3.5: Graph showing South African corporate saving rates.



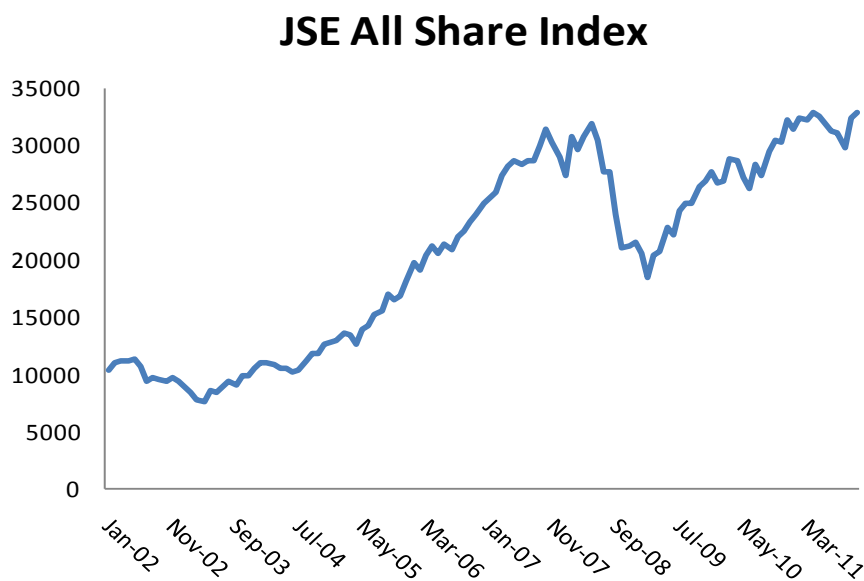
Source: SARB, 2012

Figure 3.5 above shows the trend in corporate saving rates from 2002 to 2011. It can be seen from the graph that corporate savings increased steadily over the period under review. Companies can either distribute after-tax profits as dividends or retain it in the company coffers and this decision is largely influenced by prevailing tax policies. Prinsloo (2000:15) concluded that SA tax arrangements whereby dividends were effectively taxed twice, firstly through corporate tax on company profits and secondly secondary tax paid by individuals on dividends contributed to the corporate sector saving profits rather than paying out dividends. The steadily increase in corporate savings can be attributed to the SA tax regime and other decisions not to distribute excess profits to shareholders.

3.5 The JSE All Share Index growth

The rising value of household stock holdings as a result of favourable stock market returns during the 1990s in the US turned many households into substantial wealth holders (Porteba, 2000:99). The rising stock market wealth contributed to a change in household behaviour, resulting to rising consumer spending (Porteba, 2000:100). This phenomenon had a negative impact on retail deposits as households held most of their savings in the volatile stock market and spend money that would have otherwise went to bank deposits. Figure 3.6 shows the monthly JSE returns trend over time, from 2002 to 2011. As illustrated by Figure 3.6 below, the SA stock market (JSE) experienced an unprecedented rise during the period covered by this research. The phenomenal rise was in line with other global stock markets performance but that all came to halt in the last quarter of 2007 as a result of the financial crisis emanated from the property market in the US. The JSE also posted record losses during the crisis as it shed close to 30 per cent of its value between the periods October 2007 to March 2009. This research assesses the stock market performance impact on retail deposit funds in the banking sector which in turn impacts funding liquidity risk.

Figure 3.6: Graph showing South African Stock Market growth



Source: I-net Bridge

3.6 Conclusion

The overview provided some insight into the balance sheet composition of South African banks and specific attention to concentration of liabilities to the wholesale sector which is made up of all the sectors excluding retail customers in Fig 3.3 was highlighted. Trends of household savings rate, corporate savings rate and JSE All Share Index are of interest were discussed, as they are likely to impact retail deposits which in turn affect funding liquidity risk in the banking system.

The next chapter presents the methodology for testing how these variables affect funding liquidity risk.

4. RESEARCH METHODOLOGY

4.1 Introduction

Research methodology deals with the research methods and techniques to be used. To analyse factors that contribute to the low retail funding deposits in South African banks, a sample period is analysed which covers the period immediately after the banking consolidation in 2002 when Saambou bank was put into curatorship and BOE, the sixth largest bank was integrated into Nedbank to 2011. This chapter is organised as follows, section 4.2 covers the theoretical background which covers the rationale behind choosing OLS regression analysis over other quantitative methods. Section 4.3 provides the data collection method and sources used in the study. Research questions and hypotheses are stated and discussed in section 4.4. Frequency and choice of data where it is discussed how data was manipulated to be consistent with the chosen frequency is discussed in section 4.5. Data sampling and analysis is discussed in section 4.6 and 4.7 respectively. OLS regression analysis has inherent assumptions that require testing for credibility of results and section 4.8 discusses testing techniques for these assumptions. Limitations to this study are discussed in section 4.9.

4.2 Type of research

Creswell (2002:19) describes quantitative analysis as the approach that uses *ex-post facto* or casual observations, and utilises methods such as experiments and data collection on predetermined variables that yield statistical data. Various methods can be used in quantitative or numerical analysis. Momeni *et al* (2010:524) recommends the use of a robust regression method to analyse financial data, rather than the least squares regression method. They argue that the robust regression method provides better analysis than the least squares regression method, due to its ability to eliminate or reduce the contribution of outliers and influential data in the analysis that least squares regression does not provide. In his paper criticising the use of multiple regression, Shalev (2007:261) acknowledges that indeed

alternatives and solutions to multiple regression exist, but asserts that they either require advanced technical skills, or are unconvincing in that they offer dubious solutions.

According to Shlens (2005) the principal component analysis is the most appropriate when one wishes to re-express a noisy data set to a small number of variables, called principal components, with an aim to use the principal components as a predictor in subsequent analysis. However, according to Carrascal *et al* (2008:684) greater time and effort is required, as more statistical analysis must be performed when the application of the principal component analysis is performed prior to running a multiple regression analysis. The partial least squares regression technique is mostly useful when the number of predictor variables is similar, or higher, than the number of observations; and this technique is in fact an extension of multiple regression. This research used multiple regression analysis owing to its simplicity and wide use, and because of the difficulty and unsuitability of other quantitative or numerical base methods.

4.3 Data collection

This research uses time series data that has been collected from different databases including the South African Reserve Bank (SARB), the South African Savings Institute (SASI), I-Net Bridge, and financial reports. The SARB produces a consolidated total banks data on BA 900 on a monthly basis which is freely available from their website. The BA 900 form as it is referred to, contains all the balance and off-balance sheet items of banks and thus a very comprehensive data source for balance sheet bank data. Retail rates were also obtained from the SARB website and this dissertation used the Postbank rates on term deposits to proxy retail deposit rates. This study used the money market data form SASI which publishes the unit trust data on a quarterly. Market data on the performance of the JSE wholesale money market returns is provided by I-Net Bridge, a reliable data source for up to date market data. The study uses the SA monthly data covering the period 31/01/2002 to 31/12/2011, and the linear interpolation method is applied to fill in missing data where monthly data is not available, for example, unit trust data from the Association for Savings and Investment for South Africa (ASISA) is available on a quarterly basis. In his overview of the SA banking sector (2004), Tito Mboweni, then governor of the

SARB, stated that the period between 1999 and the early 2000s saw a number of small to medium local banks exiting the banking system due to liquidity pressures and broader banking sector consolidation. Therefore, the selection of the period 2002 to 2011 was informed by the local banking sector stability after the broader consolidation.

4.4 Research questions and hypotheses

Research question 1:

Is the low rate of interest offered to retail funds, compared to interest rates offered to wholesale/institutional funding, a reason for the declining core deposits in the SA banking sector?

Money market unit trusts have experienced a phenomenal asset growth in the past 10 years as illustrated by Figure 1.4 and anecdotal evidence suggests that this recent growth is as a result of variety of factors. Among these, include a relatively high rate of return generated by these products compared to traditional bank deposits and also the flexibility with regards to withdrawal notice associated with them which are significantly shorter than bank deposits.

Research question 2:

In the SA banking sector, to what degree, if any, do household and corporate saving rates affect the level of core deposits of the banks' liabilities?

Household saving rates have declined as compared to the growth in corporate saving rates in South Africa as illustrated by Figure 3.4 and 3.5 respectively.

Research question 3:

What impact does the domestic stock market performance have on core deposits in SA banks' balance sheets?

In line with Porteba (2000) who conclude that the decline in retail or personal savings in the form of interest bearing deposits in the US since the 1980's was explained the unprecedented gains in equities/shares over the same period. The JSE All Share Index had a healthy run in the last 10 years as illustrated by Figure 3.6.

The aim of the study is to analyse the relationship between the level of retail funding in SA banks which is the indication for funding liquidity adequacy, the wholesale deposit rate, retail deposit rates, household saving rates, corporate saving rates and the JSE Index return. Literature review has found relationships between these variables, thus, the following hypotheses can be stated.

Hypothesis 1:

Competitive rates offered by banks to retail deposit funds increases the proportion of retail deposit in the funding composition of bank deposits and thus increases ROBF.

Null hypothesis (H_0): bank retail deposit rates have no effect on ROBF

Alternative hypothesis (H_1): bank retail deposit rates have a positive effect on ROBF

Hypothesis 2:

Wholesale deposit rates or money market unit trust returns indicated by STEFI have a negative impact on ROBF as these rates encourage retail depositors to divert funds that ordinarily would be deposited to banks and invest these funds in money market unit trust.

Null hypothesis (H_0): STEFI rates have no effect on ROBF

Alternative hypothesis (H_1): STEFI rates have a negative effect on ROBF

Hypothesis 3:

High and improving household saving rates indicate that individuals have more disposable income and will thus use a variety of saving products which include putting money in interest bearing accounts with banks. Therefore, positive household saving rate is likely to improve ROBF.

Null hypothesis (H_0): household saving rates have no effect on ROBF

Alternative hypothesis (H_1): household saving rates have a positive effect on ROBF

Hypothesis 4:

Companies also place deposit funds with banks whether in overnight accounts or notice deposits and they are likely to deposit more money with banks when corporate saving rates are improving. Corporate deposit with banks worsens the ROBF as it contribute to total bank deposits/funding which is the denominator in the ROBF.

Null hypothesis (H_0): corporate saving rates have no effect on ROBF

Alternative hypothesis (H_1): corporate saving rates have a negative effect on ROBF

Hypothesis 5:

Strong performance of the stock market improves personal portfolios and that could encourage people either to save less as they feel relatively wealthier or channel more money to buying additional shares and thus reducing saving from other saving vehicles. These other saving vehicles include deposit funds with banks and therefore have an effect on ROBF.

Null hypothesis (H_0): The JSE performance has no effect on ROBF

Alternative hypothesis (H_1): The JSE performance has a positive effect on ROBF

4.5 Frequency and choice of data

The research uses the SA banking monthly data covering the period 31 January 2002 to 31 December 2011, monthly money market unit trust data, quarterly household and corporate saving rates data, monthly equities, and money market returns. The researcher employed the

linear interpolation method (equation 1) to interpolate the months between quarter end months for household saving rates.

$$X_n = X_1 + \frac{X_2 - X_1}{t_2 - t_1} * (t_n - t_1) \dots \dots \dots (1)$$

Where:

X_1 = known previous month end rate;

t_1 = number of days to get to X_1 ;

X_2 = known rate for the nearest month following X_1 month end;

t_2 = number of days to get to X_2 month end;

X_n = unknown rate between X_1 and X_2 ; and

t_n = number of days to X_n .

4.6 Sampling

Given that the entire population is readily available, data used in the study encompassed the whole banking population as total banks data include all banks registered in South Africa. This research focuses on observing the relationship between funding liquidity risk as measured by the ratio of depository funding to total liabilities of a bank, and other factors over time, and that requires large data to establish reliable results.

4.7 Data analysis

Data analysis consisted of explaining the variables used in the model, the reasons for their selection, and introducing the model. The Short Term Fixed Interest Index (STeFI) reflects an investment in cash and money market instruments with a maximum maturity of twelve months, and is widely used in the SA investment fraternity. Money market instruments include negotiable certificates of deposit (NCD), treasury bills, and other short-term papers

issued by parastatals and corporates. The STeFI rate is the return earned on wholesale money markets, as these instruments have high denominations and are therefore mostly accessible to institutional money managers and other wholesale funds. Postbank investment account rates are investment returns earned by individuals referred to in this research as retail investors on bank term deposits. SA banks do not keep a history of their deposit rates and neither domestic data providers, therefore Postbank rates are preferred, as they have a history published by SARB. Household and corporate saving rates were introduced in Chapter 2. The JSE is the only stock exchange in South Africa, the researcher thus used its all share index to capture the general domestic stock market performance.

The Ordinary least squares (OLS) method is vulnerable to outlier observations in financial data, but it is the widely used statistical method in analysing financial data (Momeni *et al*, 2010:521). This study obtained multiple linear relationships between the variables and the OLS method was employed in this research. Multiple regression analysis with depository funding as ratio of total liabilities as the dependent variable was estimated. The main explanatory variables include the STeFI twelve-month money market index, twelve-month Postbank investment account rates, household and corporate saving rates, and returns of the JSE All Share Index.

The researcher states central testable predictions with the following simple multiple linear regression model;

$$y_t = \alpha_t + \beta_1 x_{1,t-1} + \beta_2 x_{2,t-1} + \beta_3 x_{3,t-1} + \beta_4 x_{4,t-1} + \beta_5 x_{5,t-1} + \varepsilon_t \dots \dots \dots (2)$$

Where:

Y_t = ROBF at time t ;

x_1 = the 12 month return of the Postbank investment account rates at time $(t - 1)$;

x_2 = the rolling 12 month STeFI return at time $(t - 1)$;

x_3 = the monthly household saving rate at time $(t - 1)$;

x_4 = the is the monthly corporate saving rate at time $(t - 1)$;

x_5 = the JSE All Share Index 12 months rolling return at time $(t - 1)$; and

ε_t = the error term.

According to Burke (2010:3) the OLS estimation has several assumptions, namely:

1. the linear model correctly describes the relationship between the dependent variable and the predictor variables;
2. residuals are uncorrelated from each other;
3. the residuals have constant variance; and
4. the residuals are normally distributed.

Violation of Assumption 1 means that the predictors might be affected by multicollinearity, and that the model is probable better expressed by another model rather than a linear model. Multicollinearity occurs when the predictors or explanatory variables are intercorrelated. Normal distribution assumption is often violated and this is due to selected sample sizes, as sampling distribution of large samples is normally distributed. Further, its violation will have no effect on the estimation of the parameters of the regression model.

4.8 Testing for OLS assumptions

Autocorrelation is prevalent if Assumption 2 above is not satisfied that the error term is uncorrelated over time. Autocorrelation indicates the correlation between a time series y_t and its own lagged values y_{t-q} with $q = -\infty, \dots, \infty$:

$$y_t = \rho y_{t-1} + u_t \dots \dots \dots (3)$$

The Durbin-Watson (DW) test is used to test for first order autocorrelation $\rho = 0$. The test statistic:

$$DW = \frac{\sum_{t=2}^T (u_{t-1} + u_t)^2}{\sum_{t=2}^T (u_t)^2} \dots \dots \dots (4)$$

If there is no serial correlation, the DW statistic will be around 2. The DW statistic will fall below 2 if there is positive serial correlation, and will lie between 2 and 4 if there is a negative correlation. For robustness and a higher order test for serial correlation (autocorrelation), this study also applied the Breusch-Godfrey(BG) test. Null hypothesis is:

H_0 : no higher order serial correlation.

We reject the null hypothesis if the p-value of the BG statistic is less than 0.05 at 95 per cent confidence interval.

Considering the regression equation above (equation 2), in testing for constant variance, also known as heteroskedasticity, the following is considered:

Null Hypothesis is of homoscedasticity in equation 6 below.

$$H_0: \text{Var}(\varepsilon \mid x_1, x_2, \dots, x_k) = \sigma^2 \dots\dots\dots(5)$$

But we assume that ε has a zero mean, thus

$$H_0: E(\varepsilon^2 \mid x_1, x_2, \dots, x_k) = E(\varepsilon^2) = \sigma^2 \dots\dots\dots(6)$$

Equation 7 indicates that we need to test whether ε^2 is related to one or more of the independent variables to test for heteroskedasticity. We use the Breusch-Pagan-Godfrey (BPG) test for this test and it is presented as:

$$F = \frac{R_{\varepsilon^2}^2 / k}{(1 - R_{\varepsilon^2}^2) / (n - (k + 1))} \dots\dots\dots(7)$$

Where we consider $\varepsilon^2 = \delta_0 + \delta_1 x_1 + \dots + \delta_k x_k + e$

e is the error term with mean zero.

The study applied the Jarque-Bera (JB) test for normality, which considers testing the null hypothesis:

H_0 : normal distribution

Against the alternative hypothesis:

H₁: non-normal distribution

$$JB = n \left[\frac{S^2}{6} + \frac{(EK)^2}{24} \right] \dots\dots\dots (8)$$

This test can also be compared with χ^2 (chi-square) distribution with 2 degrees of freedom. The null hypothesis is rejected if the calculated test statistic exceeds a critical value from the χ^2 distribution.

4.9 Limitations of Study

The research has limitations, some of which were unavoidable due to constraints beyond the researcher's control. For instance, getting actual historical retail call deposit rates from selected banks would have improved this research results as the researcher would have been able to use actual rates, but the researcher had to proxy these rates owing to difficulty of obtaining this information from the banks. The researcher therefore used the Postbank investment account rates of interest for retail deposit rates, as this information is the better available proxy for bank retail rates, and it is available from SARB's database. For the regression analysis, the study uses monthly data; however, in some instances, such as the household saving rate data from SARB (which is only published quarterly), missing data was interpolated. This method provided results that could have been more accurate if it had been actual data. In addition, the research used the savings deposits of the domestic private sector, which is a monthly figure obtained from SARB, to proxy corporate savings rates because the corporate saving rates actual data is only released annually.

5. RESEARCH FINDINGS, ANALYSIS AND DISCUSSION

5.1 Introduction

The objective of this research is to test the relationship between retail funding trends in the SA banking sector and retail deposit rates; wholesale money market rates; JSE returns; corporate saving rates; and household saving rates. Multiple regression and correlation analyses using E-Views and Excel were conducted respectively on a data sample from 2002 to 2011 to examine these relationships. Data was obtained from various sources, including SARB, I-Net Bridge and SASI.

The results from the analyses are presented in this section, and the regression outputs of other tests and testing of other statistics are presented in Appendix B.

5.2 Discussion of results

The regression analysis reveals interesting features of the SA banking system. Tables 5.1 to 5.9 summarise the descriptive statistics and analysis results. For all the regression analysis tables in Appendix B, the researcher concludes that there is no evidence to refute the significance of the model as all the significant F values are far below 0.05. The multiple regression model with all five predictors (Table 5.1 below) produced $R^2 = .8896$, three predictors (household saving rates, retail deposit rates, and the JSE All Share Index returns) have significant p-values at .0000, .0000, and .0000 respectively, and the other two independent variables (corporate saving rates and wholesale deposit rates) have p-values of .0756 and .1375 respectively. Thus, owing to their relatively high significance values, corporate saving rates and wholesale deposit rates coefficients are not reliable in the model. Regression output excluding wholesale deposit rates depicted in Table 5.2, and regression output excluding corporate saving rates presented in Table 5.3 also confirms the reliability of these two variables. The overall results as presented in Table 5.1 change very slightly when these two variables are individually excluded. For instance the R^2 changes to .08874 and

.8865 when wholesale deposit rates and corporate saving rates are excluded respectively, and this is a small change considering that the overall R^2 is .8896.

Table 5.1: Regression output with all the variables.

Dependent Variable: RETAIL_F

Method: Least Squares

Date: 02/26/13 Time: 09:48

Sample (adjusted): 2001M01 2010M11

Included observations: 119 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RETAI_R	0.274778	0.039096	7.028201	0.0000
HH_S	0.025613	0.001064	24.07813	0.0000
WHOLESALE_R	0.074625	0.049892	1.495713	0.1375
CORPORATE_S	-0.013799	0.007694	-1.793499	0.0756
JSE_R	0.014258	0.003309	4.309440	0.0000
C	0.163168	0.004431	36.82027	0.0000
R-squared	0.889669	Mean dependent var		0.188286
Adjusted R-squared	0.884787	S.D. dependent var		0.016993
S.E. of regression	0.005768	Akaike info criterion		-7.423949
Sum squared resid	0.003759	Schwarz criterion		-7.283825
Log likelihood	447.7250	Hannan-Quinn criter.		-7.367049
F-statistic	182.2385	Durbin-Watson stat		0.735610
Prob(F-statistic)	0.000000			

The coefficients are as expected, with the exception of wholesale deposit rates; corporate saving rates are negative, and this was expected because it is one of the factors that contribute to low retail deposit funds. As corporates increase their savings, the ratio of retail or depository funding to total funding at SA banks reduces, as corporate funding contributes to wholesale bank deposits. Wholesale deposit rates were expected to have a negative coefficient because when wholesale rates increase, retail depositors are expected to move their funds to unit trust funds due to their attractive rates.

The regression model was replicated with each explanatory variable excluded from the analysis, and the results are summarised from Table 5.2 to Table 5.6. The model was again replicated with only household saving rates and retail deposit rates as independent variables, and the results are depicted in Table 5.7 below. The replication was performed because both

these variables showed that they were more reliable in the model; cognizance was taken of the fact that the model results change when these two variables are individually excluded. The R^2 of the model reduces from .8896 to .8414 and .3236 when retail deposit rates and household saving rates are respectively excluded. This suggests that holding other things constant, variations in ROBF, the dependent variable is largely explained by variations in retail deposit rates and household saving rates.

Table 5.7 Regression output with Household saving rates and retail deposit rates as only explanatory variables.

Dependent Variable: RETAIL_F

Method: Least Squares

Date: 03/07/13 Time: 07:52

Sample (adjusted): 2001M01 2010M11

Included observations: 119 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RETAI_R	0.218480	0.031124	7.019666	0.0000
HH_S	0.025019	0.000958	26.12214	0.0000
C	0.176359	0.002361	74.70491	0.0000
R-squared	0.858265	Mean dependent var		0.188286
Adjusted R-squared	0.855821	S.D. dependent var		0.016993
S.E. of regression	0.006452	Akaike info criterion		-7.223893
Sum squared resid	0.004829	Schwarz criterion		-7.153832
Log likelihood	432.8217	Hannan-Quinn criter.		-7.195444
F-statistic	351.2144	Durbin-Watson stat		0.482577
Prob(F-statistic)	0.000000			

5.3 Diagnostic testing

A diagnostic test was performed to test for OLS linear regression model assumptions. Tests for multicollinearity, autocorrelation, heteroskedasticity, and normality were conducted.

Table 5.10 below depicts the correlation among predictor variables with a correlation matrix. The highest correlation is between household saving rates and retail rates at -.10464, and followed by household saving rates JSE returns at -.21254. Given that most economic variables tend to be correlated somewhat, the correlation matrix reveals that these variables are not as correlated, suggesting the presence of multicollinearity.

Table 5.10: Correlation matrix of the variables

	<i>JSE returns</i>	<i>wholesale rates</i>	<i>Corporate saving</i>	<i>HH savings</i>	<i>retail rates</i>
JSE returns	1				
wholesale rates	-0.63799	1			
Corporate saving	-0.46966	0.406757	1		
HH savings	-0.21254	0.427421	0.087226	1	
retail rates	-0.49751	0.543319	0.141552	-0.10464	1

Autocorrelation test:

An autocorrelation test reveals a positive serial correlation with the DW statistic given by formula 5 above, giving a value of .7356. This is also supported by the Breusch-Godfrey (BG) test for serial correlation that had a p-value of .0000, which is less than .05. Therefore the null hypothesis of no higher order serial correlation is rejected. The DW statistic however is not surprising, as time series data sets in economics are usually characterized by positive autocorrelation.

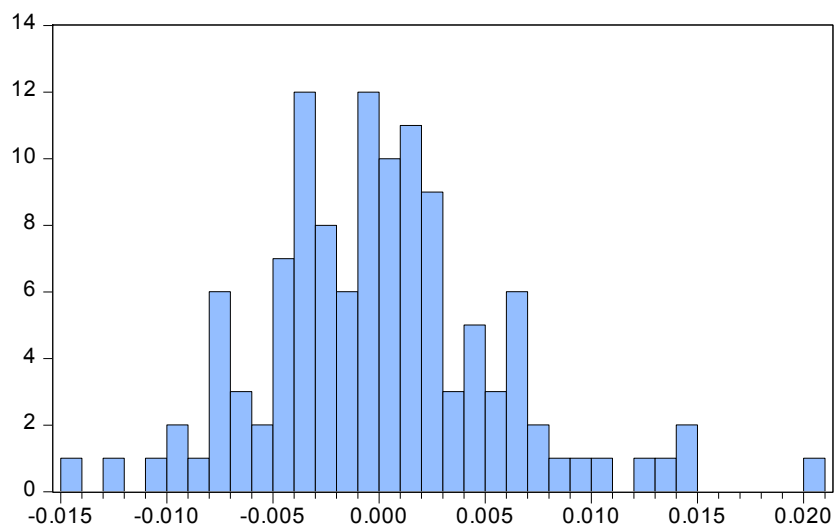
Heteroskedasticity:

For heteroskedastic errors, that is, to test whether the variances of the errors are not constant, a test was performed using the Breusch-Pagan (BP) test. The null hypothesis of no heteroskedasticity was tested, and we reject the null hypothesis as the p-value of $.0191 < .05$.

Normality test

For normality, the null hypothesis is that the residuals are normally distributed. The p-value of the JB statistic is .0010, which is $< .05$, therefore we reject the null hypothesis of normality.

Table 5.11 Testing for coefficients**Normality**



Series: Residuals
Sample 2001M01 2010M11
Observations 119

Mean -8.69e-18
Median -8.94e-05
Maximum 0.020495
Minimum -0.014118
Std. Dev. 0.005644
Skewness 0.540603
Kurtosis 4.259007

Jarque-Bera 13.65576
Probability 0.001083

Serial correlation

Breusch-Godfrey **Serial Correlation** LM Test:

F-statistic	41.25469	Prob. F(2,111)	0.0000
Obs*R-squared	50.73974	Prob. Chi-Square(2)	0.0000

Test Equation:

Dependent Variable: RESID

Method: Least Squares

Date: 02/26/13 Time: 09:49

Sample: 2001M01 2010M11

Included observations: 119

Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RETAI_R	-0.001122	0.030100	-0.037271	0.9703
HH_S	4.49E-05	0.000823	0.054562	0.9566
WHOLESALE_R	-0.009811	0.038196	-0.256858	0.7978
CORPORATE_S	0.002318	0.005885	0.393824	0.6945
JSE_R	-0.000564	0.002537	-0.222088	0.8247
C	0.001074	0.003390	0.316802	0.7520
RESID(-1)	0.774717	0.092367	8.387369	0.0000
RESID(-2)	-0.234251	0.093558	-2.503795	0.0137
R-squared	0.426384	Mean dependent var	-8.69E-18	
Adjusted R-squared	0.390210	S.D. dependent var	0.005644	
S.E. of regression	0.004408	Akaike info criterion	-7.946131	
Sum squared resid	0.002156	Schwarz criterion	-7.759299	
Log likelihood	480.7948	Hannan-Quinn criter.	-7.870265	
F-statistic	11.78705	Durbin-Watson stat	2.103298	
Prob(F-statistic)	0.000000			

Heteroskedasticity

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	2.828175	Prob. F(five,113)	0.0191
Obs*R-squared	13.23543	Prob. Chi-Square(five)	0.0213
Scaled explained SS	19.44716	Prob. Chi-Square(five)	0.0016

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Date: 02/26/13 Time: 09:51

Sample: 2001M01 2010M11

Included observations: 119

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000111	4.24E-05	-2.607077	0.0104
RETAI_R	0.000489	0.000374	1.307294	0.1938
HH_S	five.38E-06	1.02E-05	0.529134	0.5978
WHOLESALE_R	0.001006	0.000477	2.107596	0.0373
CORPORATE_S	-1.59E-05	7.36E-05	-0.215453	0.8298
JSE_R	7.15E-05	3.16E-05	2.259823	0.0257
R-squared	0.111222	Mean dependent var		3.16E-05
Adjusted R-squared	0.071896	S.D. dependent var		five.73E-05
S.E. of regression	five.52E-05	Akaike info criterion		-16.72310
Sum squared resid	3.44E-07	Schwarz criterion		-16.58298
Log likelihood	1001.024	Hannan-Quinn criter.		-16.66620
F-statistic	2.828175	Durbin-Watson stat		1.387259
Prob(F-statistic)	0.019135			

5.4 Correction of serial correlation and heteroskedasticity

The Newey-West procedure is traditionally used and has become the standard method to account for serial correlation and heteroskedasticity by modifying lag length for residuals (Peterson, 2005) and (Datta & Du, 2012). The Newey-West estimation method was applied to correct the model and a maximum lag of 12 was used, as the study used monthly data. The results are recorded in Table 5.8 and 5.9 below. The results demonstrate that all variables are significant. Corporate saving rates and the wholesale deposit rate were not significant before the correction, and their significant F values are below .05, which indicates that all variables in the model are significant.

Table 5.8: Newey-West results for the main model

Dependent Variable: RETAIL_F Method: Least Squares Date: 04/11/13 Time: 14:26 Sample (adjusted): 2001M01 2010M11 Included observations: 119 after adjustments HAC standard errors & covariance (Prewhitening with lags = 12 from AIC maxlags = 12 , Bartlett kernel, Newey-West fixed bandwidth = five.0000)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
RETAI_R	0.274778	0.022715	12.09657	0.0000
HH_S	0.025613	0.001030	24.86911	0.0000
WHOLESALE_R	0.074625	0.031838	2.343890	0.0208
CORPORATE_S	-0.013799	0.005831	-2.366633	0.0197
JSE_R	0.014258	0.001729	8.244657	0.0000
C	0.163168	0.001435	113.7402	0.0000
R-squared	0.889669	Mean dependent var		0.188286
Adjusted R-squared	0.884787	S.D. dependent var		0.016993
S.E. of regression	0.005768	Akaike info criterion		-7.423949
Sum squared resid	0.003759	Schwarz criterion		-7.283825
Log likelihood	447.7250	Hannan-Quinn criter.		-7.367049
F-statistic	182.2385	Durbin-Watson stat		0.735610
Prob(F-statistic)	0.000000			

Table 5.9: Newey-West results for the household saving rates and deposit rates as only dependent variables model

Dependent Variable: RETAIL_F Method: Least Squares Date: 04/11/13 Time: 14:27 Sample (adjusted): 2001M01 2010M11 Included observations: 119 after adjustments HAC standard errors & covariance (Prewhitening with lags = 2 from AIC maxlags = 12 , Bartlett kernel, Newey-West fixed bandwidth = five.0000)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
RETAI_R	0.218480	0.081755	2.672388	0.0086
HH_S	0.025019	0.001747	14.32474	0.0000
C	0.176359	0.005537	31.85284	0.0000
R-squared	0.858265	Mean dependent var		0.188286
Adjusted R-squared	0.855821	S.D. dependent var		0.016993
S.E. of regression	0.006452	Akaike info criterion		-7.223893
Sum squared resid	0.004829	Schwarz criterion		-7.153832
Log likelihood	432.8217	Hannan-Quinn criter.		-7.195444
F-statistic	351.2144	Durbin-Watson stat		0.482577
Prob(F-statistic)	0.000000			

5.5 Conclusion

This research utilised the OLS multiple regression analysis to study the relationship between the retail/depository funding ratio of total bank funding and five predictors (wholesale deposit rates, retail deposit rates, JSE All Share Index returns, corporate saving rates, and household saving rates) in the SA banking sector. The multiple regression analysis model is significant, and it revealed some features of the causes of low retail funding in the SA banking sector. Household saving rates have been declining for the past decade and although they are marginally improving they are still negative, as depicted in figure 2.1. It is not surprising that it is a significant factor in causing the low retail funding in the local banking sector, as households use a variety of investment vehicles to save, including bank deposits. Thus, as revealed by the regression model, the improvement in household saving rates will have a positive impact on the level of retail or depository funding in local banks. The dependent variable is a ratio whose denominator includes corporate funds invested in local banks, and as expected, it has a negative coefficient in the regression model. This means that as corporates increase their savings, which are likely to end up in local banks, the ratio of retail deposits to total funding decreases.

The other three variables – the JSE All Share Index, wholesale deposit rates, and retail rates – refute the following perceptions. Firstly, when the stock or shares market is performing well – which in our case it has done (see Fig 2.2) – households will either withdraw money from their banks to buy shares, or halt depositing money with banks and buy shares instead, thus reducing retail funding in the local banks. Secondly, when the wholesale funding market receives more attractive rates of interest than retail deposits, either via money market unit trusts or other forms, which has been the case in the local markets, households will move money away from banks and invest with unit trust managers. These funds in turn provide banks with a pool of money through purchases of NCD, Promissory Notes (PN) or similar instruments, hence increasing wholesale funding with banks and in the process exacerbating

the ROBF. Thirdly, high retail deposit rates offered by banks will encourage households to choose bank deposits as a preferable form of saving, owing to its relatively high rates of return. None of these three perceptions were supported by the regression model, suggesting that their impact on retail funding in local banks is non-existent or minimal.

6. RESEARCH CONCLUSIONS

6.1 Summary and findings

The funding liquidity risk predicament that exists in the SA banking sector in a form of undesirable low retail funding proportion of total banks funding was researched, and it was concluded that the declining and low household saving rates is one the main contributors to the low retail funding. In addition, corporate saving rates were found to have a negative relationship with the ratio of retail funding to total funding in the time series data used. This research has shown that understanding the key drivers of retail depository funding is important in assisting banks to come up with strategies to attract retail finds.

6.2 Recommendations and Policy implications

The SA banking and financial sector is advanced and very competitive and continues to adapt to changes from both global financial architecture challenges and regulatory space, as is evident by the aftermath of the 2007/8 financial crisis and the looming Basel III requirements. This competitiveness also means that product development inside and outside of the banking sector to attract surplus funds is rampant, and this does not bode well for the funding liquidity risk quagmire that the banking sector faces. SA Banks need to adopt different strategies to attract retail funds into their balance sheets, and more needs to be done to make retail deposit options competitive to institutional and professional funds. This research revealed that deposits from institutions such as corporate and money managers get preferential interest rates that are generally higher than retail deposit interest rates from banks. Owing to the attractive rates received by institutional funds, households choose to invest their funds in a pool with other investors in the form of money market unit trusts where they receive attractive rates of interest, as is evident in the phenomenal growth of money market unit trusts in recent years, thus starving banks of much needed funds.

The risk return profile of depositing money with a bank does not make sense to any rational retail depositor or investor, as both retail and institutional funds bear the same risks, that is,

of losing their funds should be a run on their bank. However, institutional funds get substantially higher interest rates than retail funds. To level the playing field between these two sources of funding options, two remedies exist. Firstly, banks can increase interest rates offered to retail deposits to the same or similar level to that offered to money market funds and corporates. Secondly, the risk return feature of deposit funds should be adjusted to justify the discrepancy in the interest rate offered to these depositors, and this could be done via the establishment of a deposit insurance corporation. Deposit insurance will counter the attractiveness of high wholesale deposit rates by offering retail depositors with insurance that wholesale deposit funds will not have, thus making retail funds less risk if a bank experiences a run and become insolvent. What shape should this institution take?

There is extensive literature on the design and effectiveness of deposit insurance. Diamond & Dybvig (1986:57) argue that the institutional design of deposit insurance can be more effective if deposit insurance premiums paid by banks are based on the bank's risk appetite, and that premiums should increase or decrease with a bank's non-performing loans profile. The SA banking sector is very similar to the Canadian banking sector in that it is well regulated and dominated by a few large banks; the option for policy makers would be to establish a deposit insurance similar to the Canadian deposit insurance structure, but adjust it to make it suitable for SA conditions. For instance, it could be stated that in order for deposits to be eligible for deposit insurance, they must be South Africa Rand based and payable in South Africa. In addition, only certain types of deposits should be insurable, including;

1. savings and cheque accounts;
2. term deposits that are payable within five years after the date of deposit; and
3. money orders and cheques issued by deposit insurance members.

There could be an eligibility criterion; such an example could be where policy makers decide on the maximum protection for eligible deposits, that is, a maximum eligible deposit of R100 000 per depositor in each of the institutions covered by deposit insurance (banks). It should also be explicit that the purpose of the deposit insurance is to insure only retail depositors, as professional money managers who manage money market unit trust funds have risk management

strategies, which retail depositors do not have. Therefore not only deposit insurance will assist the banking industry attract depository funding due to low risk of these funds it will also shield banks from experiencing runs from retail depositors during stress period, and thus promotes financial stability.

Further, the work that has been undertaken by National Treasury, SASI and ASISA in encouraging the culture of saving should be extended to banks and/or the Banking Association of South Africa (BASA). Banks can create products that will appeal to households and obtain much needed funding in the process. Therefore the higher the proportion retail deposits to total liabilities in banks' balance sheets the more resilient the banking industry will be to funding liquidity crises.

7. RECOMMENDATIONS FOR FUTURE RESEARCH

The Basel III LCR and NFSR funding liquidity requirements which are due to be implemented by global banks (G20 countries), including SA banks, in 2015 and 2018 respectively, will bring fundamental changes to the business model of banks, particularly in the asset-liability management (ALM) space. These liquidity requirements will be a huge challenge for SA banks given the structure of the local funding market where funding is concentrated in the short-term. Thus, an area for further study could be the need to link to the Basel III preparation, which is likely to compel the banking industry to change its funding profile of the balance sheet as it seeks to lengthen it with stable sources of funding and the funding liquidity that exists. As banks lengthen their funding with stable sources of funds, retail deposits are likely to be an area of focus as it best provides stable funding sources.

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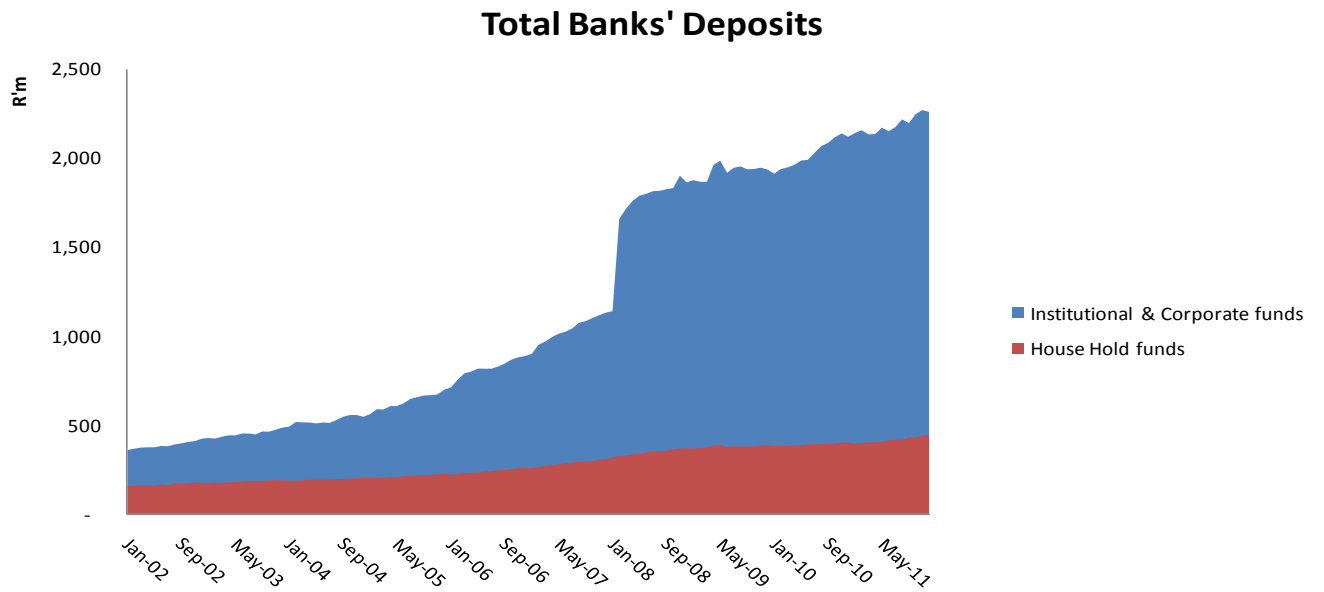
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APPENDIX A

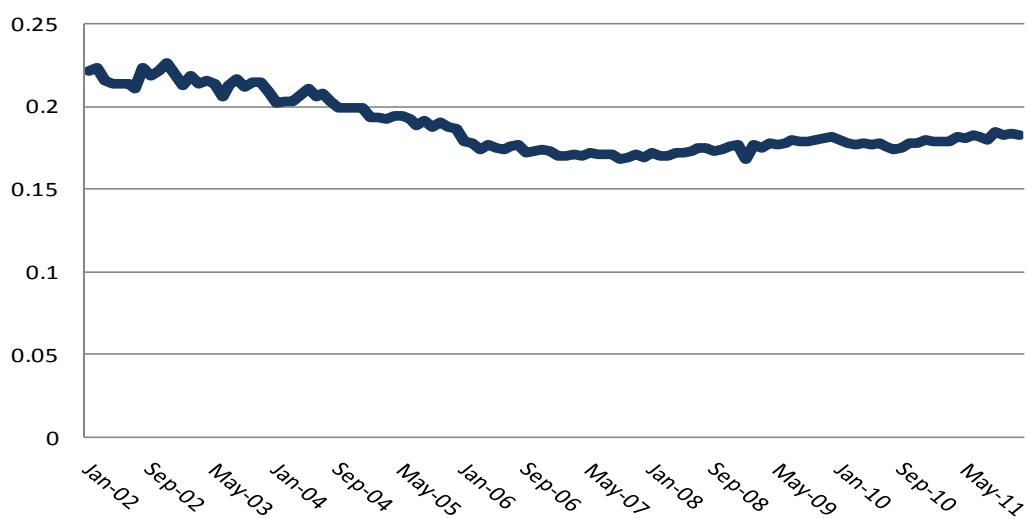
Figure 1.1 : Graph showing Total Banks' Deposits of South African Banks



Source: SARB, 2012

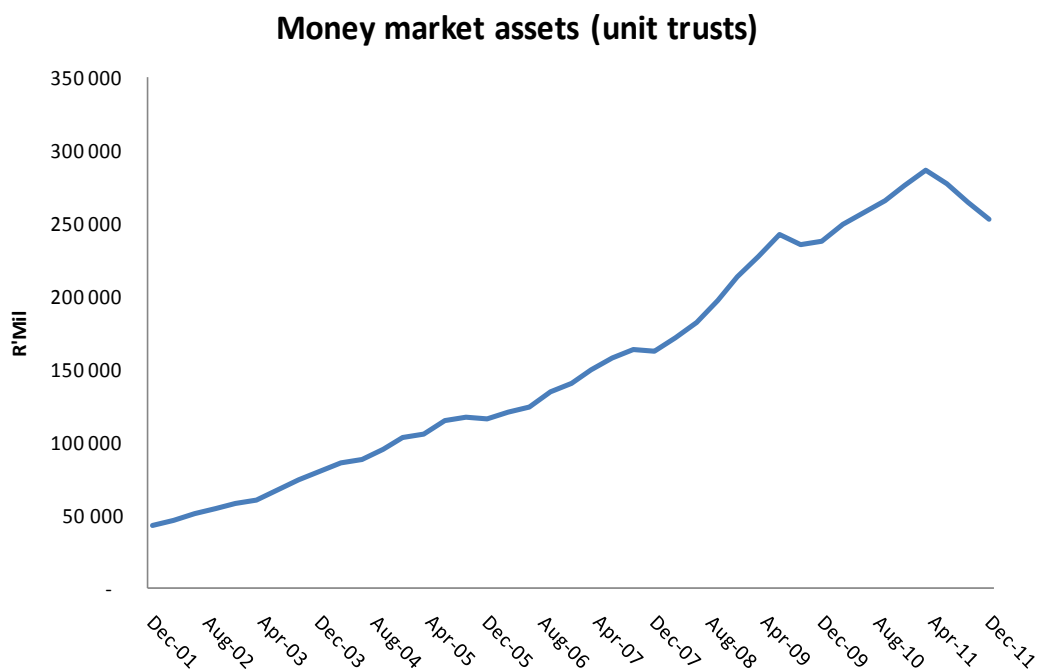
Figure 1.2: Graph showing the decline of Depository/Retail funding proportion of Banks total deposits.

Depository Funding Proportion to Total Deposits



Source: SARB, 2012

Figure 1.3: Graph showing South African Money market unit trust growth



Source: ASISA, 2012

APPENDIX B

Table 5.2: Regression output excluding ratio of wholesale deposits rates.

Dependent Variable: RETAIL_F
Method: Least Squares
Date: 02/26/13 Time: 09:57
Sample (adjusted): 2001M01 2010M11
Included observations: 119 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RETAI_R	0.305583	0.033412	9.146005	0.0000
HH_S	0.026456	0.000907	29.15774	0.0000
CORPORATE_S	-0.010552	0.007421	-1.421825	0.1578
JSE_R	0.012831	0.003185	4.028384	0.0001
C	0.168299	0.002820	59.67051	0.0000
R-squared	0.887485	Mean dependent var		0.188286
Adjusted R-squared	0.883537	S.D. dependent var		0.016993
S.E. of regression	0.005799	Akaike info criterion		-7.421151
Sum squared resid	0.003834	Schwarz criterion		-7.304381
Log likelihood	446.5585	Hannan-Quinn criter.		-7.373735
F-statistic	224.7993	Durbin-Watson stat		0.726770
Prob(F-statistic)	0.000000			

Table 5.3: Regression output excluding corporate saving rates

Dependent Variable: RETAIL_F
Method: Least Squares
Date: 02/26/13 Time: 10:04
Sample (adjusted): 2001M01 2010M11
Included observations: 119 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RETAI_R	0.292592	0.038179	7.663607	0.0000
HH_S	0.025965	0.001056	24.59697	0.0000
WHOLESALE_R	0.049373	0.048328	1.021640	0.3091
JSE_R	0.016258	0.003145	five.168949	0.0000
C	0.163713	0.004464	36.67554	0.0000
R-squared	0.886529	Mean dependent var		0.188286
Adjusted R-squared	0.882547	S.D. dependent var		0.016993
S.E. of regression	0.005824	Akaike info criterion		-7.412688
Sum squared resid	0.003866	Schwarz criterion		-7.295918
Log likelihood	446.0549	Hannan-Quinn criter.		-7.365271
F-statistic	222.6644	Durbin-Watson stat		0.722082

Prob(F-statistic) 0.000000

Table 5.4: Regression output excluding retail deposit rates

Dependent Variable: RETAIL_F
Method: Least Squares
Date: 02/26/13 Time: 09:55
Sample (adjusted): 2001M01 2010M11
Included observations: 119 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
HH_S	0.022181	0.001128	19.66529	0.0000
WHOLESALE_R	0.259345	0.050616	five.123818	0.0000
CORPORATE_S	-0.027538	0.008882	-3.100476	0.0024
JSE_R	0.007723	0.003790	2.037856	0.0439
C	0.166635	0.005256	31.70226	0.0000
R-squared	0.841440	Mean dependent var		0.188286
Adjusted R-squared	0.835877	S.D. dependent var		0.016993
S.E. of regression	0.006884	Akaike info criterion		-7.078108
Sum squared resid	0.005402	Schwarz criterion		-6.961338
Log likelihood	426.1474	Hannan-Quinn criter.		-7.030692
F-statistic	151.2431	Durbin-Watson stat		0.481023
Prob(F-statistic)	0.000000			

Table 5.5: Regression output excluding JSE All Share Index returns

Dependent Variable: RETAIL_F
Method: Least Squares
Date: 02/26/13 Time: 09:59
Sample (adjusted): 2001M01 2010M11
Included observations: 119 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RETAI_R	0.227427	0.040309	five.642123	0.0000
HH_S	0.025202	0.001138	22.14203	0.0000
WHOLESALE_R	0.012628	0.051323	0.246054	0.8061
CORPORATE_S	-0.024972	0.007782	-3.208731	0.0017
C	0.175028	0.003731	46.90543	0.0000
R-squared	0.871537	Mean dependent var		0.188286
Adjusted R-squared	0.867029	S.D. dependent var		0.016993
S.E. of regression	0.006196	Akaike info criterion		-7.288595
Sum squared resid	0.004377	Schwarz criterion		-7.171825
Log likelihood	438.6714	Hannan-Quinn criter.		-7.241178
F-statistic	193.3530	Durbin-Watson stat		0.593286

Prob(F-statistic) 0.000000

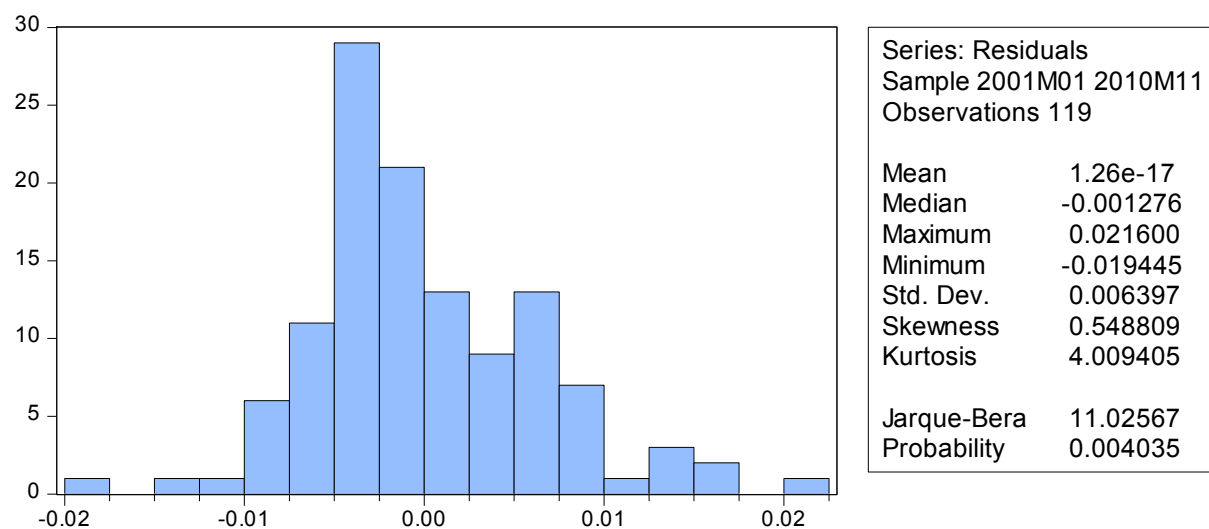
Table 5.6: Regression output excluding household saving rates

Dependent Variable: RETAIL_F
Method: Least Squares
Date: 02/26/13 Time: 09:57
Sample (adjusted): 2001M01 2010M11
Included observations: 119 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RETAI_R	0.305583	0.033412	9.146005	0.0000
HH_S	0.026456	0.000907	29.15774	0.0000
CORPORATE_S	-0.010552	0.007421	-1.421825	0.1578
JSE_R	0.012831	0.003185	4.028384	0.0001
C	0.168299	0.002820	59.67051	0.0000
R-squared	0.887485	Mean dependent var		0.188286
Adjusted R-squared	0.883537	S.D. dependent var		0.016993
S.E. of regression	0.005799	Akaike info criterion		-7.421151
Sum squared resid	0.003834	Schwarz criterion		-7.304381
Log likelihood	446.5585	Hannan-Quinn criter.		-7.373735
F-statistic	224.7993	Durbin-Watson stat		0.726770
Prob(F-statistic)	0.000000			

Table 5.12: Testing of coefficients with only two independent variable

Normality



Serial correlation

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	80.07768	Prob. F(2,114)	0.0000
Obs*R-squared	69.51711	Prob. Chi-Square(2)	0.0000

Test Equation:

Dependent Variable: RESID

Method: Least Squares

Date: 03/07/13 Time: 07:54

Sample: 2001M01 2010M11

Included observations: 119

Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RETAI_R	-0.005009	0.020321	-0.246512	0.8057
HH_S	1.98E-05	0.000625	0.031581	0.9749
C	0.000361	0.001540	0.234724	0.8148
RESID(-1)	0.903851	0.091923	9.832702	0.0000
RESID(-2)	-0.199812	0.092470	-2.160839	0.0328
R-squared	0.584177	Mean dependent var	1.26E-17	
Adjusted R-squared	0.569587	S.D. dependent var	0.006397	
S.E. of regression	0.004197	Akaike info criterion	-8.067777	
Sum squared resid	0.002008	Schwarz criterion	-7.951007	
Log likelihood	485.0327	Hannan-Quinn criter.	-8.020360	
F-statistic	40.03884	Durbin-Watson stat	2.047467	
Prob(F-statistic)	0.000000			

Heteroskedasticity

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	3.704714	Prob. F(2,116)	0.0276
Obs*R-squared	7.144689	Prob. Chi-Square(2)	0.0281
Scaled explained SS	10.21541	Prob. Chi-Square(2)	0.0060

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Date: 03/07/13 Time: 07:54

Sample: 2001M01 2010M11

Included observations: 119

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.53E-05	2.53E-05	-0.998499	0.3201
RETAI_R	0.000904	0.000333	2.711779	0.0077
HH_S	five.14E-06	1.03E-05	0.500816	0.6174
R-squared	0.060039	Mean dependent var		4.06E-05
Adjusted R-squared	0.043833	S.D. dependent var		7.07E-05
S.E. of regression	6.91E-05	Akaike info criterion		-16.29626
Sum squared resid	five.54E-07	Schwarz criterion		-16.22620
Log likelihood	972.6274	Hannan-Quinn criter.		-16.26781
F-statistic	3.704714	Durbin-Watson stat		1.265761
Prob(F-statistic)	0.027565			